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Use of Steel and Tantalum Apparatus for Molten Cd-Mg-Zn Alloys

Pyrochemical processes for the recovery of uranium-base reactor fuels generally involve selective oxidation and reduction, extraction, fractional crystallization, volatilization, and phase separations in liquid metal-molten salt solvents at temperatures up to 800°C. The zinc-magnesium system, initially selected as the metal solvent for uranium, is very corrosive and can be contained only in tungsten, tungsten alloys, or certain ceramics such as alumina or beryllia at the temperatures and zinc concentrations of process interest. Therefore, a search for less corrosive metal solvents was undertaken. Attention was directed to cadmium-base alloys because cadmium has a relatively low melting point (321°C) and can be contained in steel and tantalum apparatus. Zinc and magnesium are added to the cadmium to produce desirable solubility effects, especially to increase the solubility of uranium. Accordingly, a program was set up to evaluate the use of steel and tantalum for the containment of various ternary alloys of cadmium, zinc, and magnesium.

Carbon steel (1020) and type 405 stainless steel exhibited excellent corrosion resistance to cadmium-magnesium-zinc alloys at zinc concentrations below 30 atom percent and temperatures up to 750°C. Corrosion rates of these steels increased with increasing concentrations of zinc in the ternary alloy. Type 304 stainless steel was severely corroded as the result of nickel leaching by the solvent alloys. Except at high zinc concentrations (greater than 95 percent by weight), tantalum exhibited good corrosion resistance

at temperatures up to 850°C. The effect of stress on the corrosion behavior was not investigated experimentally, but this factor is not considered to be significant for the intended application.

Note:

Additional details pertaining to this investigation are given in "Corrosion of Steels and Tantalum by Molten Cadmium-Magnesium-Zinc Systems" and "Corrosion of Refractory Metals by Zinc-Magnesium-Uranium and Halide Salt Systems" in *Electrochemical Technology*, Sept.-Oct., 1965, p 258-262, 263-269. Inquiries may also be directed to:

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Patent status:

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